ORIGINAL ARTICLE

CAN THE ROLE OF THE ACROMION INDEX IN THE DIAGNOSIS OF ROTATOR CUFF TEAR BE REDEFINED WITH A DIFFERENT MEASUREMENT TECHNIQUE?

Rotator Cuff Yırtığı Tanısında Akromion İndeksinin Rolü Farklı Bir Ölçüm Tekniği ile Yeniden Tanımlanabilir mi?

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ABSTRACT

Objective: Many radiographic parameters associated with Rotator Cuff Tears (RCT) have been described. Our aim is to measure the capacity to predict RCT by reinterpreting the Acromion Index (AI) with a new radiographic measurement technique.

Material and Methods: The shoulder Magnetic Resonance Imaging (MRI) report of a total of 62 patients and AI measured with the new technique in shoulder radiographs were evaluated. On shoulder radiographs, the glenohumeral length was identified as the length between the lateral humerus tuberculum majus and the anterior midpoint of the glenoid joint. The glenoacromial length was also defined from a different pers-pective as the length between the lateral tip of the acromion and the anterior midpoint of the glenoid joint.

Results: There was no significant difference in glenohumeral length between patients with complete and partial RCT and those without RCT (p = 0.163). There was no significant difference in glenoacromial length between these three groups of patients (p = 0.110). It was concluded that there was no significant difference between the three groups of patients in terms of AI that we redefined (p = 0.095).

Conclusion: AI of the glenohumeral and glenoacromial lengths, which were redefined with a different measurement technique on the shoulder radiography, did not yield statistically significant results in the diagnosis of shoulder RCT.

Keywords: *Rotator Cuff, Acromion Index, Glenohumeral, Glenoacromial*

ÖZET

Amaç: Rotator Manşet Yırtıkları (RCT) ile ilişkili olarak tanımlanan birçok radyografik parametreden birisi olan Akromion indeksini (AI) yeni bir radyografik ölçüm tekniği ile yeniden yorumlayarak RCT'yi tahmin etme kapasitesini ölçmektir.

Gereç ve Yöntemler: Toplam 62 hastanın omuz Manyetik Rezonans Görüntüleme (MR) raporu ve omuz grafilerinde yeni teknikle ölçülen glenohumeral ve glenoakromiyal uzunlukla hesaplanan AI değerlendirildi. Omuz grafilerinde glenohumeral uzunluk, lateral humerus tuberculum majus ile glenoid eklemin ön orta noktası arasındaki uzunluk olarak tanımlandı. Glenoakromiyal uzunluk, akromiyonun lateral ucu ile glenoid eklemin ön orta noktası arasındaki uzunluk olarak da farklı bir bakış açısıyla tanımlandı.

Bulgular: MR'da tanımlanan tam ve kısmi RCT'li hastalar ile RCT'siz hastalar arasında direk grafideki glenohumeral uzunluk açısından anlamlı fark yoktu (p = 0,163). Bu üç hasta grubu arasında direk grafideki glenoakromiyal uzunluk açısından anlamlı bir fark yoktu (p = 0,110). Direk grafide yeniden tanımladığımız AI açısından üç hasta grubu arasında anlamlı bir fark olmadığı sonucuna varıldı (p = 0,095).

Sonuç: Omuz radyografisinde farklı bir ölçüm tekniği ile yeniden tanımlanan glenohumeral ve glenoakromiyal uzunluklarla tanımlanan AI'si, omuz RCT tanısında istatistiksel olarak anlamlı sonuçlar vermemiştir.

Anahtar Kelimeler: *Rotator Manşet, Akromion İndeksi, Glenohumeral, Glenoakromiyal*

INTRODUCTION

Shoulder pain is widespread musculoskeletal discomfort with a prevalence percentage ranging from 7% to 26% in the population (1). The most widespread cause of shoulder pain in the population is rotator cuff tendinopathy which is a multifactorial status (2). The prevalence of Rotator Cuff Tears (RCT) is 22.1% in the community and increases with age. Asymptomatic rupture of the rotator cuff is twice as common as symptomatic rupture (3). The rotator cuff consists of four muscles and tendons of these muscles that fix the humeral head in the shoulder joint and prevent the deltoid muscle from pulling the humeral head up. Therefore, when there is RCT, the humeral head moves upwards. In the evaluation of this condition of the shoulder, radiography is primarily used in the first imaging because it is inexpensive and easily accessible. Although more advanced imaging techniques are available, they are not primarily preferred due to their high cost and difficult accessibility. In previous studies, different measurement methods were applied to evaluate the relationship between shoulder radiography and RCT (4–8). The acromial index, which is the ratio of the glenohumeral length to the glenoacromial length, is one of them. Studies have not found a relationship between the acromial index and the development of RCT (7,8).

In this study, we hypothesized that when Acromion Index (AI) was calculated from a different perspective, it might be associated with RCT. We changed the glenohumeral length and glenoacromial length measurement technique. This study aimed to detect whether there is a relationship between the ratio of glenohumeral length to glenoacromial length measured with the new technique on shoulder radiography and shoulder Magnetic Resonance Imaging (MRI) reports in terms of RCT.

MATERIAL AND METHODS

We examined the data of patients retrospectively who applied to our orthopedics outpatient clinic with the complaint of shoulder pain, and who had shoulder radiography and MRI. Ethical approval was obtained for the study from the Clinical Research Ethics Committee (2017-KAEK-189_2019.03.13_08). Informed consent was obtained from all patients participating in the study. Those who had a previous surgical procedure in the shoulder region, those who had a fracture in the shoulder region, and those who had any deformity in the shoulder region were excluded from the study. Patients who applied to the orthopedics and traumatology outpatient clinic, who had shoulders MRI and radiographs for any reason and who had no shoulder bone deformation were determined as inclusion criteria.

Shoulder radiography and MRI of a total of 62 patients suitable for our study were evaluated from the hospital archive. These patients were examined in 3 groups; 18 with complete RCT, 25 with partial RCT, and 19 without RCT, according to the MRI report. The glenohumeral length and glenoacromial lengths were measured on the shoulder radiographs of the patients with the new technique we developed (Fig 1).

We measured the glenohumeral length which is the length between the lateral humerus tuberculum majus and the anterior midpoint of the glenoid joint on the shoulder radiograph. We also calculated the glenoacromial length between the lateral tip of the acromion and the anterior midpoint of the glenoid joint from a different perspective. The ratio of the glenohumeral length to the glenoacromial length was recorded. According to the shoulder MRI report of the same patient, the rotator cuff was grouped as complete RCT, partial RCT or intact RCT.

Statistical analysis of this study was evaluated in groups with glenohumeral length, glenoacromial length, glenohumeral length to glenoacromial length, complete RCT, partial RCT and without RCT. The differences between the groups were examined using the Mann-Whitney U test in the paired groups and the Kruskal-Wallis Test in the triple group. Statistical significance was assumed as $p<0.05$.

RESULTS

The mean glenohumeral length of patients with complete and partial RCT and without RCT was found to be 55.378mm±3.853, 56.944mm±5.207, 58.926mm±5.577, respectively. The mean glenoacromial length in these 3 groups of patients was measured as 56.772mm±4.695, 60.440mm±4.624, and 59.589±5.899, respectively. In addition, the mean ratio of glenohumeral length to glenoacromial

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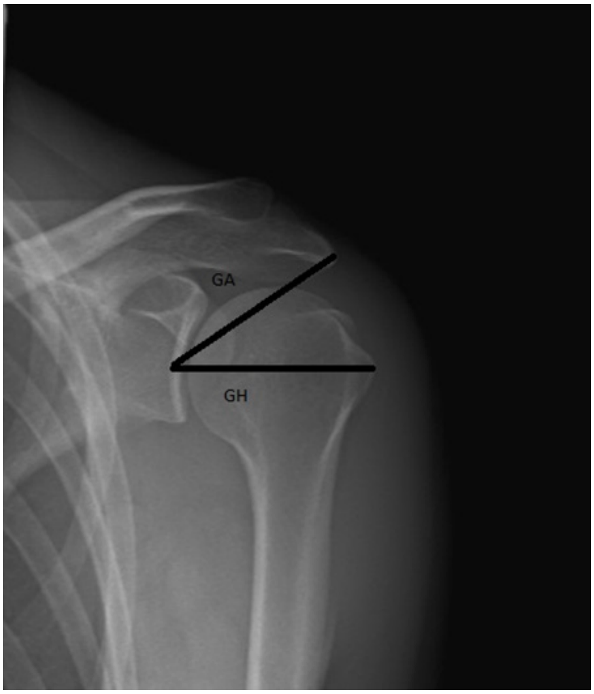
Figure 1. Redefined glenohumeral and glenoacromial lengths, GH: Glenohumeral, GA: Glenoacromial



length in these 3 groups of patients was found to be 0.979±0.074, 0.943±0.060, 0.991±0.065, respectively. There was no significant difference in glenohumeral length between patients with partial RCT and complete RCT, patients with partial RCT and without RCT, patients with complete RCT and without RCT ($p = 0.514$, $p = 0.184$, $p = 0.064$, respectively). There was no significant difference in glenoacromial length between patients with partial RCT and complete RCT, patients with partial RCT and without RCT, patients with complete RCT and without RCT ($p = 0.032$, $p = 0.670$, $p = 0.176$, respectively). There was no significant difference in AI between patients with partial RCT and complete RCT, patients with partial RCT and patients without RCT, patients with complete RCT and without RCT ($p = 0.115$, $p = 0.044$, $p = 0.715$, respectively). There was no significant difference in glenohumeral length between patients with complete and partial RCT and patients without RCT ($p = 0.163$) (Table 1). There was no significant difference between these 3 groups of patients in terms of glenoacromial length ($p = 0.110$). In addition, there was no significant difference in AI between these 3 groups of patients ($p = 0.095$).

DISCUSSION

In this study, we calculated the acromial index from a different perspective. We questioned the usability of the ratio of glenohumeral length to glenoacromial length, which we measured with a new shoulder radiography technique as a diagnostic tool in rotator cuff pathologies. We used shoulder radiography to estimate RCT and MRI reports as references. Shoulder radiography is preferred as primary imaging to rule out possible causes of shoulder pain, such as osteoarthritis, fracture, and shoulder dislocation because more advanced imaging modalities are not usually routinely used in primary clinical examination (9).

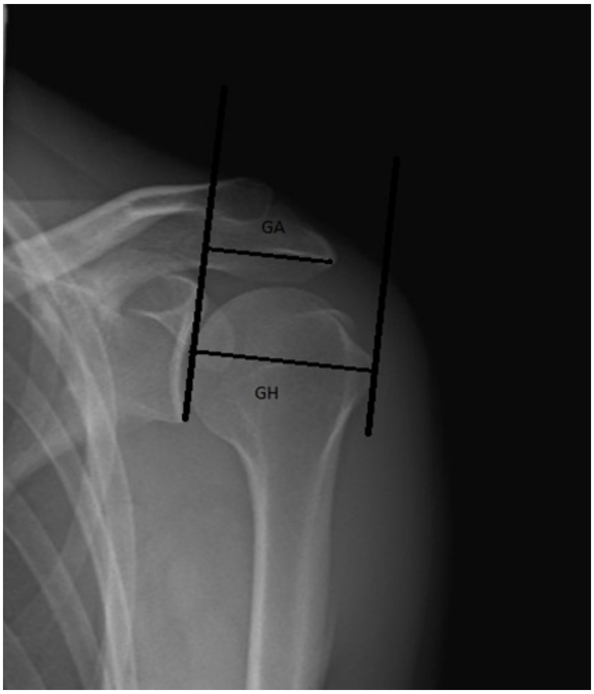
In our study, AI results measured with the new technique were similar between patients with complete, and partial RCT and without RCT. Some authors have stated that AI is not a significant indicative value for evaluating rotator cuff rupture (Fig 2) (7,10,11). In a study by Hsu et al., it was stated that AI did not show any difference in predicting supraspinatus tendinopathy in patients with shoulder pain (12). On the other hand, in another study, AI results in rotator cuff pathologies in the Korean population were significantly different between healthy and patient groups, but the relationship between AI and the size of RCT could not be demonstrated (13). Researchers showed that AI was an effective predictive factor for RCT in the Korean population. Some researchers have suggested that RCT may be associated with a larger AI, that is, a longer lateral projection of the acromion (14). Likewise, in other examinations, AI may be an indicator to differentiate preoperative partial and massive RCT. They suggested that a high AI may be one of the associated factors for the progression to massive RCT in rotator cuff disease (15). According to some authors, the different results of studies on AI question the reliability of AI and its relationship with cuff pathologies (7). In a scant study of seven shoulder impingement pain patients with a mean age of 34 years and 13 healthy controls, they found no significant difference in acromiohumeral length between the groups (16). In summary, the acromiohumeral length is primarily genetically detected and is less influenced by external items (17). The upward movement of the

Table 1. Distribution of patient groups according to Glenohumoral (GH), Glenoacromial (GA) and Acromion Index (AI)

	Tear type	*N*	*Mean*	*Min.*	*Max.*	*Sd*	*p value**
GH Distance	Partial RCT	25	56.944	50.1	69.1	5.206	0.163
	Complete RCT	18	55.377	47.2	63.5	3.85	
	Without RCT	19	58.92	49.5	69.8	5.57	
GA Distance	Partial RCT	25	60.44	52.2	69.4	4.62	0.11
	Complete RCT	18	56.77	46.8	64	4.69	
	Without RCT	19	59.58	49.7	67.7	5.89	
Ratio (AI)	Partial RCT	25	0.94	0.84	1.035	0.059	0.095
	Complete RCT	18	0.978	0.845	1.120	0.074	
	Without RCT	19	0.989	0.9	1.122	0.0662	

*= Kruskal Wallis Test, p<0.05, RCT= Rotator Cuff Tears

Figure 2. Glenohumeral and glenoacromial lengths, GH: Glenohumeral, GA: Glenoacromial



humeral head is known as the progressive phenomenon caused by the imbalance between the force pairs of the rotator cuff muscles (18). Radiographic assessments of acromiohumeral intervals by independent physicians demonstrated researchers' high reliability when using standard radiographs (19). When it comes to evaluating the inferior surface of the acromion in patients with as distinct from shaped acromions, radiography is more prone to misinterpretation than MRI. In addition, while the shoulder is in internal or external rotation during glenohumeral radiography, it affects the measurements, while MRI is not affected by rotation and accurate measurements are made (20). In contrast, the use of non-standardized radiographs by orthopedic surgeons has shown that the measurement of the acromiohumeral space is not reliable and reproducible (4). Thus, we used only standard anteroposterior shoulder radiographs and MRIs in our study. In this study, we measured the acromial index questioned by previous publications from a different perspective, thus providing a new perspective. We found that AI measured with the new technique was not associated with the RCT. There were no statistically significant results between AI results measured by the new technique between patients with complete or partial RCT and those without RCT. Thus, we supported previous publications stating that the relationship between AI and rotator cuff pathologies was not significant. This study has several limitations. First, the measurement of AI measured by the new technique on radiographs, although non-standardized radiographs are excluded, may have biased the results as it is attached to the quality of the radiographs. Another limitation is the small and different count of patients in all groups. In the end, selection bias may have emerged as we involved only symptomatic patients, potentially reducing the correctness of the control group, which may include asymptomatic individuals with shoulder pathology.

CONCLUSION

In this study, no relationship was found between the ratio of the glenohumeral length to the glenoacromial length and the RCT status. By looking at it from a different angle, we did not obtain a significant result in terms of radiography diagnosis of shoulder RCT in AI with our newly formed measurement.

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